

CONSERVATION OF MEDICINAL PLANTS: A REVIEW

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ABSTRACT

Ayurveda [traditional medicine of India as per WHO], the holistic science of medicine, as practised and utilized by Indians at large since centuries is now being globally accepted which has increased the demand for medicinal plants. Majority of population in the developing countries like India depends on the traditional systems of medicine like Ayurveda for their primary healthcare needs. Increasing demand of medicinal plants leads to irrational cutting deforestation leading to depletion of the wild resources. Moreover, the natural and manmade calamities lead to further depletion of medicinal plant diversity. Conservation aims at supporting sustainable development by wing the biological resources in ways that don't deplete the world's variety of species or destroy their ecosystems. It involves measures such as collection, propagation, evaluation, disease identification and elimination, storage and distribution. Conservation of medicinal plants and their genetic resources can be undertaken by in-situ and ex-situ conservation. Ex-situ conservation involves conservation of medium plants outside their natural habitat used to safeguard them from destruction, replacement or deterioration. Ex-situ conservation includes procedure like seed storage, DNA storage, field gene banks and botanical gardens etc

Keywords: Ayurveda, Medicinal plants, Conservation, In-situ, Ex-situ.

INTRODUCTION

WHO (World Health Organization) estimated that 80 percent of people worldwide rely on the traditional systems of medicines for some aspect of their primary health care needs. According to WHO, around 21,000

plant species have the potential for getting used as medicinal plants. Thus, the economic importance of medicinal plants is much more to countries such as India than to rest of the world.^[9] India has a rich resource

base of medicinal plants, plush with about 8,000 different species. According to the Government of India (GoI), traditional medicines are the sole means of health care for about 65 percent of the population.^[6] Treatment with medicinal plants is considered very safe as there is no or minimal side effects. These remedies are in sync with nature, which is the biggest advantage. The golden fact is that, use of herbal treatments is independent of any age groups and the sexes.^[9] Increasing demand of medicinal plants leads to irrational cutting deforestation leading to their depletion in wild. Moreover, the natural and manmade calamities lead to further depletion of medicinal plant diversity. The flora of the world is being destroyed at an alarming rate. The tropical moist forests, home to about half the world's plants, are especially danger, declining at an estimated 16.8 million ha/annum consistent with UNEP/FAO. Combined with exploitation, this is often putting many medicinal plants in grave risk of genetic erosion and even extinction.^[4]

In order to serve the health needs, Various conservation measures must be undertaken. Conservation is an act of careful preservation and protection of natural resources or habitats of medicinal plants especially through planned management.^[8] It will keep check on their rational and legal collection and maintain their biodiversity in the wild.^[3]

DISCUSSION

Need For Conservation

Conservation aims at supporting sustainable development by wing the biological resources in ways that don't deplete the world's variety of species or destroy their ecosystems. It involves measures such as collection, propagation, evaluation, disease identification and elimination, storage and distribution. Conservation of medicinal plants and their genetic resources can be undertaken by in-situ and ex-situ conservation. Ex-situ conservation involves conservation of medium plants outside their natural habitat used to safeguard them from destruction, replacement or deterioration. Ex-situ conservation includes procedure like seed storage, DNA storage, field gene banks and botanical gardens etc.^[1]

Traditional Methods of Conservation: People living in rural areas mainly depend on their surrounding forests and vegetation for fuel wood and medicine. This population cannot afford alternative fuel and expensive modern medicines. Hence, the environmental degradation and ecological loss takes place for which serious measures must be undertaken. Conservation of medicinal plants can be done by discouraging people for cutting down trees and encouraging them to plant fast-growing indigenous trees for their domestic used. But this alone cannot majorly lead to conservation. Therefore, other newer conservation strategies must be planned and brought into action. Biotechnological techniques and procedures must be used for the same.

[Fig. 1 Diagram of methodological systems involved in the conservation of medicinal plants]

1. To Conserve Medicinal Plant Species *In Situ* -

In-situ method of conservation deals with the "on-site conservation" of the wild genetic diversity in natural habitat. In India, the conservation of forest areas preserves through Protected Areas like National Parks, Wildlife Sanctuaries and Biosphere Reserves.^[8] The Government should prepare a policy at national level on the conservation and utilization of medicinal plants in protected areas. This type of conservation is achieved both by setting away areas as nature reserves and wild nurseries and by ensuring that as many wild species as possible can still survive in managed habitats, like farms and plantation forests.^[4] The Government should assess the extent to which the protected areas system covers the medicinal plants of the country. Species that are heavily depleted by over-collection should be re-introduced into areas where they originally grew in wild.

Natural Parks - Natural Parks are protected areas of important wild resources created to preserve and restore biodiversity.^[17,18] Around the world, more than 12,700 protected areas have been established.^[19] Conserving medicinal plants in their natural habitat requires evaluating the contributions and ecosystem roles of individual habitats.^[20]

E.g. Velavadar National Park in Gujarat, Ranthambore National Park in Rajasthan, Corbett National Park in Uttarakhand.^[14]

Wild nurseries - The populations of medicinal plants are under heavy burden because of overexploitation, habitat degradation and invasive species, wild nurseries can provide an effective approach for in situ conservation of medicinal plants that are endemic, threatened, and in-demand. [11]

E.g. Periyar Wildlife Sanctuary, Bandipur Wildlife Sanctuary in Karnataka and the Dandeli Wildlife Sanctuary in south India. [14]

Biosphere Reserves – Out of the 34 biodiversity rich spots in the world, three lies in India; they are the Western Ghats, the Eastern Himalayas and Indo-Burma region. There are 18 biosphere reserves in India. These aim at securing the ecosystem by stopping irresponsible interference of humans with the ecosystem and also to conserve the endemic and endangered species. Out of these 18, 4 are part of the World Network of Biosphere Reserves. [14]

E.g. Nilgiri 2000, Sunderban, 2001, Nanda Devi, 2004, Pachmarhi, 2009, Great Nicobar, 2013, Agasthyamala, 2016 and Khangchendzonga, 2018. [16]

2. To Conserve Medicinal Plant Species Ex Situ - *Ex-situ* conservation deals with the “off-site conservation” of the wild genetic resources in natural habitat. It includes the collection, preservation and maintenance of certain genetic resources from wild. *Ex-situ* method of conservation is a complementary action to conserve the genetic diversity, thereby reducing pressure on wild environments and enhancing raw material availability. For many species of medicinal plants their wild population is on life-threatening level and it is not suitable for dealing *in-situ* conservation action. It can be served as field gene banks and also help to engaging the number of stakeholders in production and regeneration of medicinal plants. [8]

Botanic gardens – should set up seed banks for the medicinal plants native and cultivated in the country. Botanic gardens should set up alternative means of ex situ conservation for those species which cannot be stored in seed banks. Botanical Survey of India is actively engaged in the ex-situ conservation through its chain of Botanic gardens established in different regional circles. [15]

E.g. Government Botanical Gardens in Tamil Nadu, Garden of Medicinal Plants in west Bengal and Empress Garden in Maharashtra [14]

Seed banks – Seed banks proposed a better way of storing the genetic diversity of many medicinal plant's ex situ than through botanic gardens. They are recommended to help preserve the genetic diversity of wild medicinal plant species. Seed banks allow quick access to plant samples for the evaluation of their properties. The challenging tasks of seed banking are how to introduce again the plant species back into the wild and how to actively assist in the restoration of wild populations. [15]

Field Gene Banks - Field gene banks conserve plants by using tools of biotechnology. These include –

In vitro conservation :

In vitro propagation and re-introduction of plants to their natural habitats.

Molecular marker technology :

Various In-vitro techniques have been developed to store vegetatively propagated seed producing species. These can be categorised as –

- slow growth procedures, where germplasm is kept as sterile plant tissue, or as plantlet on nutrient gel.
- Cryopreservation, where plant materials are stored in liquid nitrogen. [2]

I. Germplasm Technique of Conservation -

Germplasm conservation of vegetative propagated plants and forest species in life field gene banks require land and labour for annual or perennial replanting. On the other hand, in-vitro or reduced growth storage require little space in growth rooms which maintain thousands of genotypes together, reduces pest attack and diseases in the culture vessels. It further eliminates the need for long procedures during movement and exchange of germplasms. [3]

This technique also has certain disadvantages as follows -

- Certain plants may not produce viable seeds.
- Certain plant seeds deteriorate rapidly due to seed-borne pathogens.
- Certain plant seeds are heterogenous and are not suitable for maintaining true to type genotypes.

- Application of cryopreservation technology can circumvent the above problems.

II. Cryopreservation Technique of Conservation –

Cryopreservation is defined as the viable freezing of biological material and their subsequent storage at ultra-low temperature (-196°C) using liquid nitrogen.^[3]

[Fig. 1 Diagram of methods Of Cryopreservation]

New Cryopreservation techniques –

- a. Encapsulation and dehydration.
- b. Vitrification
- c. Encapsulation and vitrification
- d. Desiccation
- e. Pre-growth
- f. Pre-growth and Desiccation
- g. Droplet freezing

Tissue Culture Techniques Used For Conservation –

Plant tissue culture is the in vitro aseptic culture of cells, tissues, organs or whole plant under controlled nutritional and environmental conditions.^[23]

Application of Cryopreservation and Tissue culture techniques –

- Plant species where regeneration by conventional methods is difficult, tissue culture is applied to propagate them and prevent them from extinction.
- Plants species whose population has decreased due to over exploitation can be preserved by tissue culture.
- Plant species which exhibit variability in their medicinal properties with respect to the active principle.
- Plants yielding higher amount of active principle can be conserved using tissue culture techniques.

3. Cultivation Practice -

In order to meet the increasing demand, conservation and cultivation of medicinal plants has become important. Conservation involves imposing certain regulations on their collection from the wild. If such irrational collection continues, many plant species which are widely available today will become endangered. Some may even become extinct. For their conservation, the proper cultivation methods must be encouraged. Medicinal plants collected from the wild normally vary

in composition and quality, due to the environmental and genetic differences. This variation and the uncertainty in their therapeutic benefit can be much reduced by their proper cultivation. The possibility of misidentification and adulteration also greatly reduces due to cultivation. Thus, medicinal plant cultivation can help in the conservation of the wild stocks and can fulfil the global health needs.^[12]

CONCLUSION

Day by day demand of medicinal plants is increasing exponentially, causing depletion of naturally occurring resources. Therefore, it is urgent need to focus on conservation of medicinal plants so that it will compensate loss of wild variety of plant sources as well as complement demand of medicinal plants. Various conservation techniques discussed above can initiate and support conservation management and sustainable wage of medicinal plants for human healthcare needs. The best means of conservation is to make sure that the populations of species of plants still grow and evolve within the wild in their natural habitats.

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Figure 1: Diagram of methodological systems involved in the conservation of medicinal plants

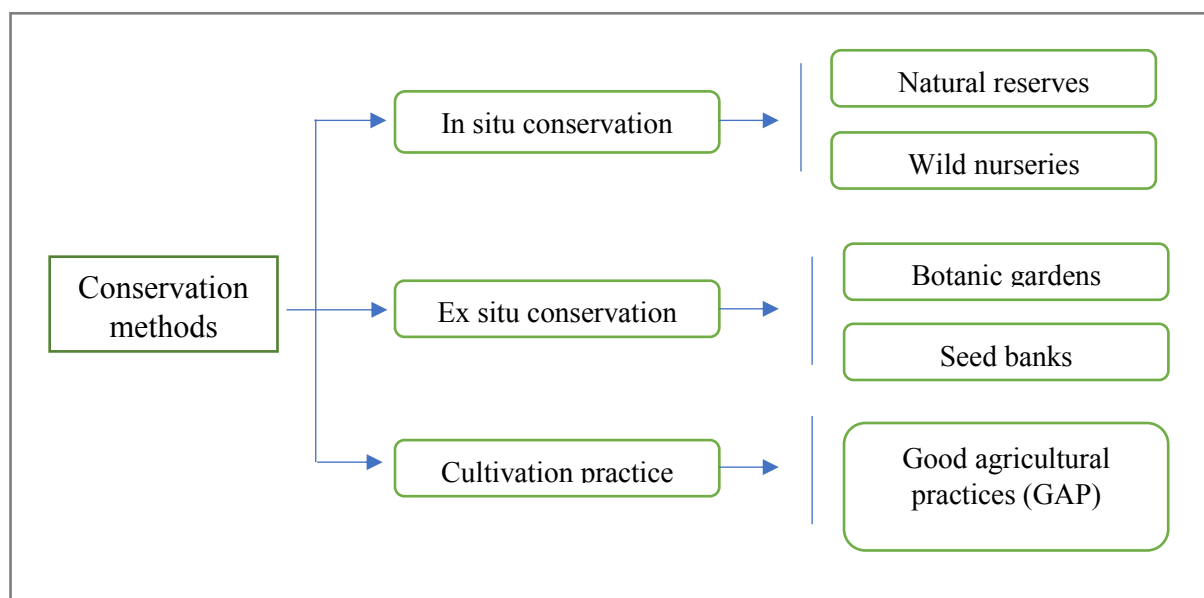
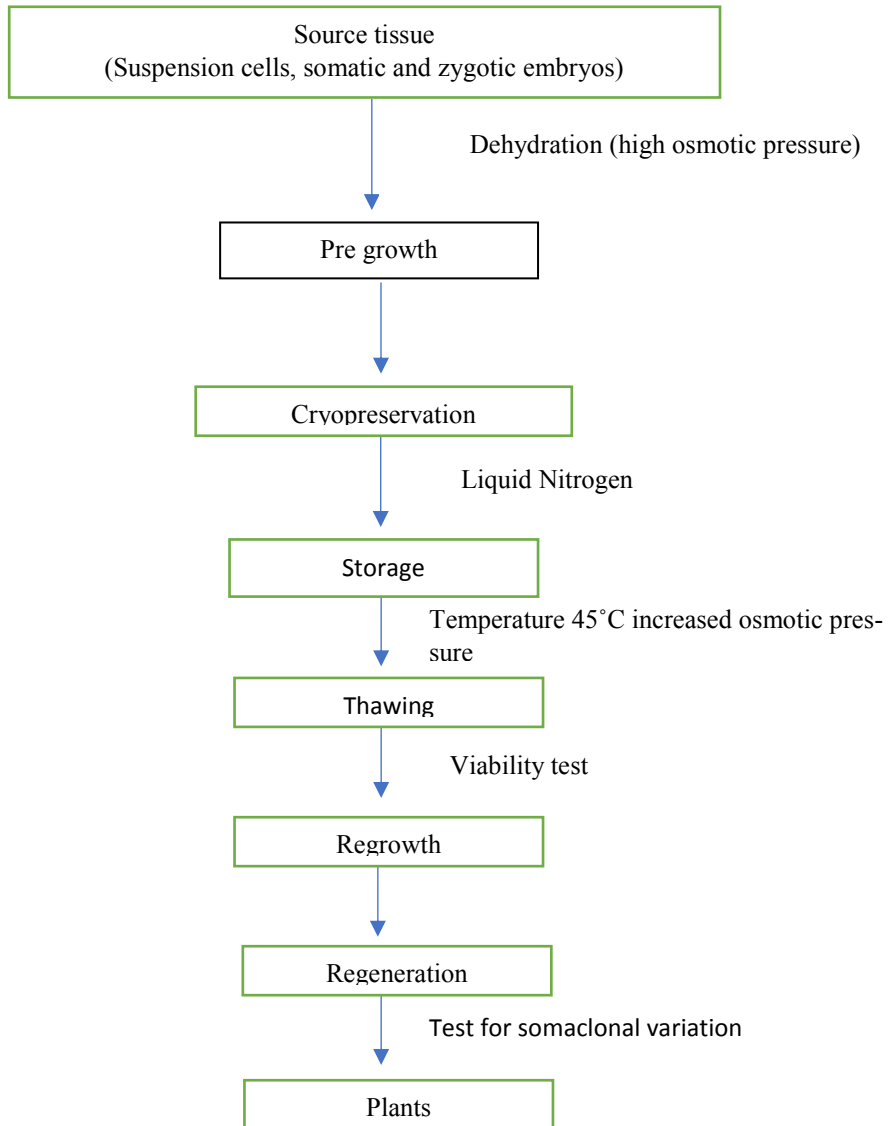


Figure 2: Methods of Cryopreservation



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